THE CRITICAL PATH

A FLIGHT PROJECTS DIRECTORATE PUBLICATION ■ 2017 SPRING ISSUE

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Enabling exploration and Earth + space science by transforming concepts and questions into reality

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THE CRITICAL PATH

PUBLISHED BY THE FLIGHT PROJECTS DIRECTORATE

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HAVE A STORY IDEA, NEWS ITEM OR LETTER FOR THE CRITICAL PATH?
Please let us know about it.

Send your input to
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PHONE
Ext. 6-9125

Don't forget to include your name and phone number.

The deadline for the next issue is July 14, 2017

WE'RE ON THE WEB
Visit the new
Code 400 home page
http://fpd.gsfc.nasa.gov

Since the last Critical Path newsletter, GOES-16 (formerly GOES-R) "opened its eyes" and provided the world with dramatic pictures of our home planet. Congratulations to the team for the success of this critical mission phase. Spacecraft checkout continues to go well prior to handover to NOAA. Likewise, OSIRIS-REx is also performing well on its journey to the asteroid Bennu and back. Raven reached its destination at the International Space Station and has already been performing wonderfully as the Station's newest externally-attached payload. On the heels of these missions are a slew of other missions on the countdown to launch in the next 12 months. They include: NICER, JPSS-1, TDRS-M, TSIS, ICON, GOLD, TESS, and GOES-S. Busy times for our project teams are on the horizon in the months ahead.

Inside Goddard's integration and test facility, the JWST team is completing its final checks of the telescope following a very successful vibration and acoustic test program. On March 31 and April 1, Goddard employees and JWST friends and family were invited to see this remarkable telescope as it was positioned front and center in the cleanroom. In early May this amazing telescope will leave Goddard and move to its next test location at the Johnson Space Center (JSC)—a huge project milestone.

On the new business front, congratulations are in order for the Lucy mission team on its selection by NASA to move forward to Phase B. Lucy is a partnership with Southwest Research Institute (including the principal investigator), Goddard, and Lockheed Martin. This mission will tour the Trojan asteroid belt.

I also want to acknowledge the incredible work of the DAVINCI and PRAXyS proposal teams. Although they were not selected, their efforts were commendable. So much effort is put into these multi-year endeavors and we truly appreciate what it takes to deliver

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such high-quality proposals. I'm sure that we will take away a lot from these efforts that can be used on future missions.

Meanwhile, several New Frontiers teams are now poised to submit their Step-1 proposals to NASA Headquarters on April 28.

In the area of Space Communications, the future of optical communications at GSFC could not be brighter. NASA Headquarters has approved the JSC/Orion Project's choice to establish a long-term relationship with GSFC starting with EM-2 (with a projected launch readiness date of ~2021).

Regarding NASA's budget in general, I urge our teams to stay optimistic. There are opportunities for us to look at efficiencies through innovation. Of significance, we've recently held strategic retreats at both the Code 100 and Code 400 levels. There are a lot of initiatives in play that will benefit Goddard now and in the future.

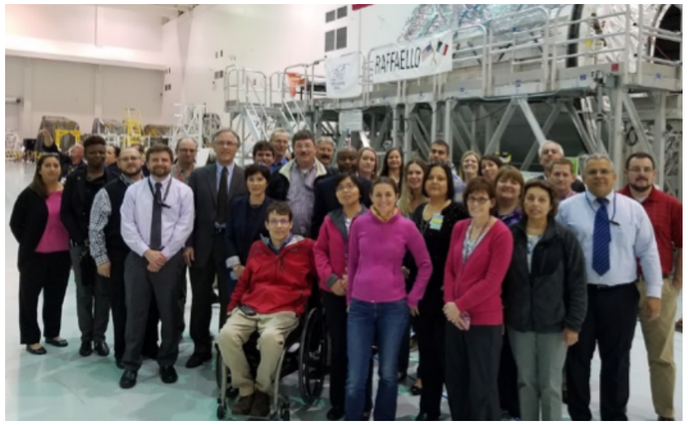
Finally, later in this newsletter on page 15, you will see a video tribute from Center Director, Chris Scolese, on the loss of several NASA "giants" who worked at Goddard: Piers Sellers, Marty Davis, Phil Sabelhaus and Neil Gehrels. These extremely talented pioneers leave a long-lasting and positive imprint on Goddard and its present and future missions. I will miss each one of these fine men and I am grateful for the time we all had to work with them. ▲

Dave

David F. Mitchell
Director, Flight Projects
david.f.mitchell@nasa.gov

WHAT'S UP WITH THE FLIGHT PROJECTS DEVELOPMENT PROGRAM COHORT #2?

The Flight Projects Development Program (FPDP) is a rigorous, two-year program designed to develop highly skilled flight project management personnel through an accelerated learning and development curriculum. Participants attend required and elective coursework, complete two specially selected work assignments, attend various developmental opportunities, receive comprehensive mentoring, and develop a Capstone Project.



Cohort #2 officially commenced in April 2016. During year one, the participants were assigned to their first work assignment. The FPDP work assignments are selected by the FPDP Governance Board, currently chaired by Dave Mitchell, FPD Director. The work assignments are foundational to the program and fill identified gaps, enhance the participant's understanding of flight project management, and provide hands-on, real-world experiences. The participants are fully engaged in their first work assignment and are currently serving in the following positions:

Mellani Edwards – LCRD Business Project Management
Wen-ting Hsieh – HIRMES Technical Instrument Project Manager
Obadiah Kegege – OCI Technical Instrument Project Management
Vanessa Soto Mejias – WFIRST Business Project Management
Brian Thomas – SSPD Business Project Management

On March 14 and 15, 2017, the cohort participated in a workshop at the Kennedy Space Center. The workshops are Goddard sponsored agency-wide offerings designed to provide unique and timely information and access to future and current project managers from across NASA as well as to NASA and industry senior leaders and subject matter experts.

The cohort is also currently working to select their Capstone project from a list of five Center/Code 400 problems that were presented to them by the FPDP Governance Board. Over the course of the next 11 months, Cohort #2 will develop their Capstone Project and will present their Capstone product and recommendations to the FPDP Governance Board in April 2018.

For more information about the FPDP, please refer to the charts at the following link, **https://fpdspi.gsfc.nasa.gov/sites/400/400fpdoffice/FPD/Lists/FPD%20Announcement%20Board/Attachments/1/FPDP%20Cohort%202%20Overview%20Presentation%20September%202015.pdf** or feel free to contact Cecilia Allen Czarnecki, at Cecilia.A.Czarnecki@nasa.gov or 6-7398.

CECILIA A. CZARNECKI, CODE 400
FPD ASSISTANT DIRECTOR

GOES-R LAUNCHES

WHAT IS THE GOES-R SERIES?

Since 1975, the National Oceanic and Atmospheric Administration's (NOAA's) Geostationary Operational Environmental Satellites (GOES) have provided continuous imagery and data on atmospheric conditions and solar activity. The GOES-R series is the nation's next generation of geostationary weather satellites which will significantly improve the detection and observation of environmental phenomena that directly affect public safety, protection of property, and our nation's economic health and prosperity.

The satellites will provide advanced imaging with increased spatial resolution and faster coverage for more accurate forecasts, real-time mapping of lightning activity, and improved monitoring of solar activity and space weather. The first light data and imagery from each of the six instruments on board the satellite have been released and calibration and validation activities are now underway.

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CREDIT: UNITED LAUNCH ALLIANCE

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The GOES-R series is a four-satellite program (GOES-R, S, T and U) that will extend the availability of the operational GOES satellite system through 2036. The first satellite in the series, GOES-R, launched on November 19, 2016, from Space Launch Complex 41 at Cape Canaveral Air Force Station, Florida, aboard an Atlas V 541 rocket. Upon reaching geostationary orbit, the satellite became known as GOES-16. GOES satellites are designated with a letter prior to launch. Once a satellite reaches its orbit it is assigned a number. GOES-16 is currently undergoing an extended checkout and validation phase and will be fully operational in November 2017.

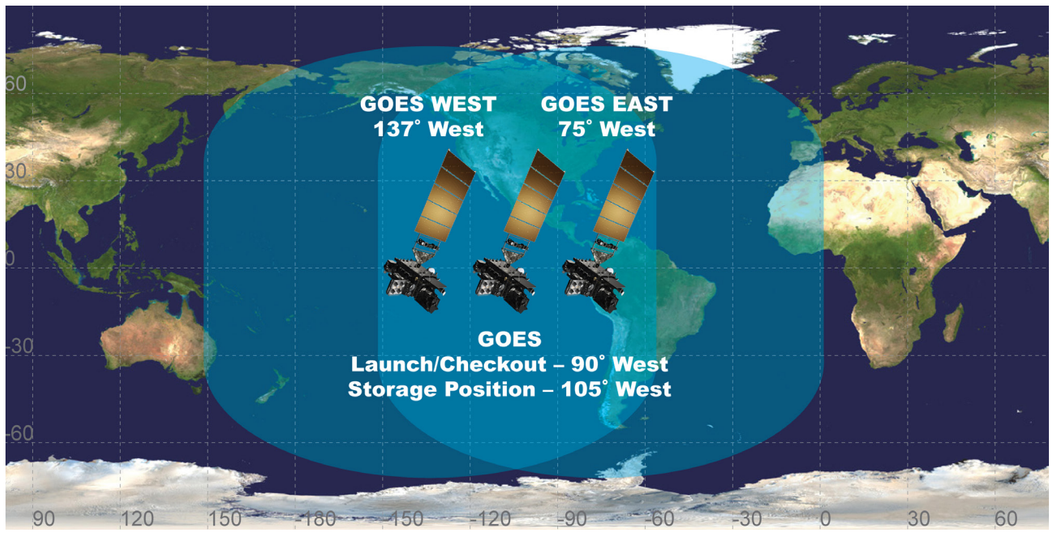
Fully assembled GOES-R spacecraft. Credit: Lockheed Martin

Learn more in the "What is GOES-R?" video at **https://youtu.be/6Q7Leqvzfg4**.

View videos and photos of the GOES-R launch at **https://go.usa.gov/xXqKt**.

WHAT DO NOAA'S GEOSTATIONARY SATELLITES SEE?

Geostationary satellites rotate with Earth from west to east directly over the equator at an altitude of approximately 35,800 km (22,300 statute miles). Because they orbit in the same direction as Earth turns on its axis and match the speed of Earth's rotation at the equator, the satellites always have the same view of the Earth's surface. NOAA's geostationary satellites are in position to maintain a constant vigil of the weather over nearly half the planet from Guam to the west coast of Africa. GOES West views the west coast of the United States and Pacific Ocean and GOES East keeps watch over the east coast and Atlantic Ocean. NOAA also maintains an on-orbit spare GOES in the event of an anomaly or failure of GOES East or GOES West.



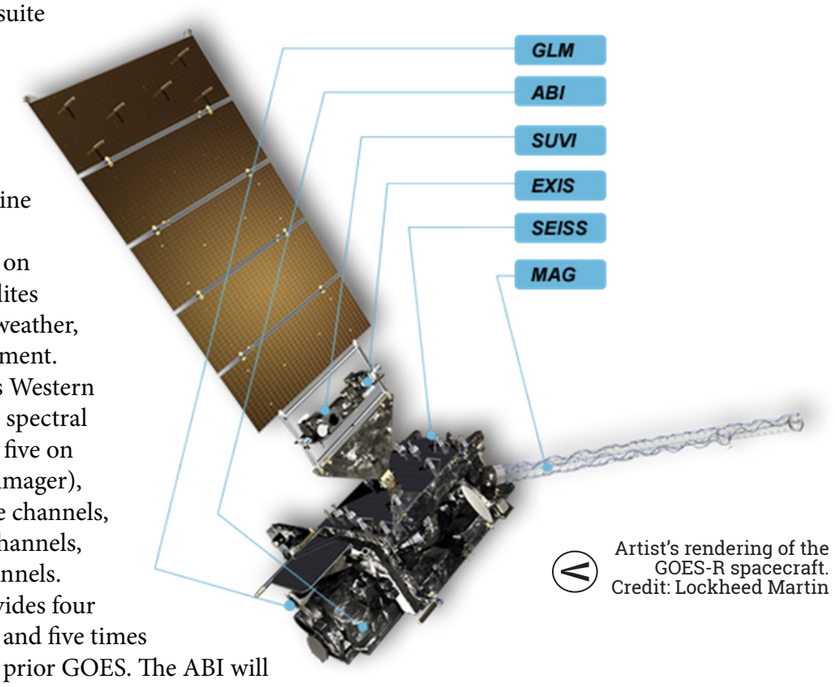
Current GOES fleet. Credit: NOAA

HOW DOES NASA GODDARD SUPPORT THE GOES-R SERIES PROGRAM?

The GOES-R series program is a collaborative effort between NOAA and NASA to develop, deploy, and operate the satellites. The program is managed by NOAA with an integrated NOAA-NASA program office organization, staffed with personnel from NOAA and NASA, and supported by industry contractors. The program is located at NASA's Goddard Space Flight Center and is composed of the GOES-R Program Office and two integrated NOAA-NASA project offices: the Flight project and the Ground Segment project. The Flight project oversees the development of the space segment of the mission, which consists of the spacecraft, the instruments, launch vehicle, and the auxiliary communication payloads. The Ground Segment project oversees the development of software and hardware for satellite command and control, along with science data processing and distribution to end users. It also oversees the development of the ground-based communications networks, radio frequency systems, and the necessary facility improvements needed to support the GOES-R series of satellites.

WHAT PAYLOADS DO GOES-R SERIES SATELLITES CARRY?

The satellites host a suite of instruments to improve monitoring of both terrestrial and space weather. The Advanced Baseline Imager (ABI) is the primary instrument on GOES-R series satellites for imaging Earth's weather, oceans, and environment. ABI observes Earth's Western Hemisphere with 16 spectral bands (compared to five on the previous GOES imager), including two visible channels, four near-infrared channels, and ten infrared channels. The instrument provides four times the resolution and five times faster coverage than prior GOES. The ABI will be used for a wide range of applications related to weather, oceans, land, climate, and hazards (fires, volcanoes, floods, hurricanes, and storms that spawn tornadoes). The ABI can provide images of weather and severe storms as frequently as every 30 seconds, which will lead to more accurate, reliable weather forecasts and severe weather outlooks.



Artist's rendering of the GOES-R spacecraft. Credit: Lockheed Martin

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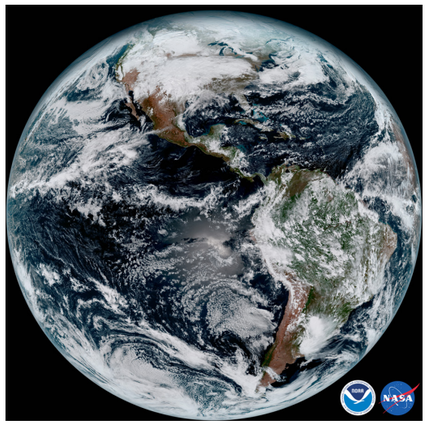
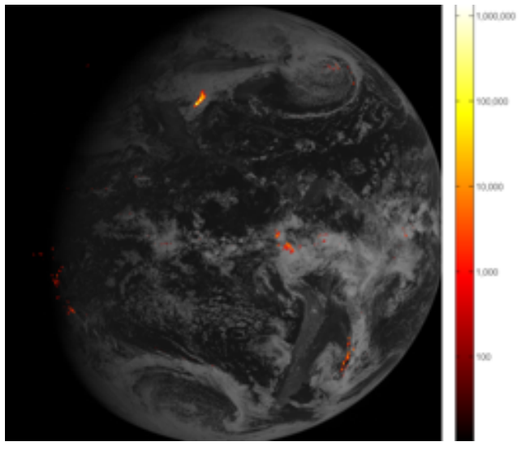


This composite color full-disk visible image of North and South America and the surrounding oceans is from January 15, 2017, and was created using several of the 16 spectral channels available on the GOES-16 ABI.
Credit: NOAA/NASA

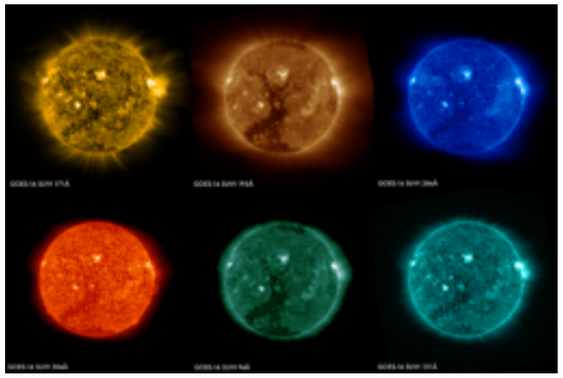
The **Geostationary Lightning Mapper (GLM)** is the first operational lightning detector flown in geostationary orbit. The GLM measures total lightning activity – cloud-to-ground discharges and the even more common in-cloud lightning. The instrument detects and maps total lightning activity throughout the day and night over the Americas and adjacent ocean regions with near-uniform spatial resolution. It collects information such as the location, brightness, and extent of lightning discharges to identify strengthening storms, which are often accompanied by increased total lightning activity. Used in combination with radar, data from ABI, and surface observations, GLM data has great potential to increase lead time for severe thunderstorm and tornado warnings.



GOES-16 Geostationary Lightning Mapper (GLM) lightning data accumulated over one hour, during which GLM acquired 1.8 million images of the Earth, is displayed over ABI full disk Band 2 imagery on the afternoon of February 14, 2017. Brighter colors indicate more lightning energy was recorded; color bar units are the calculated kilowatt-hours of total optical emissions from lightning. The brightest storm system is located over the Gulf Coast of Texas. Credit: NOAA/NASA

View a movie of the first GLM data overlaid on ABI imagery at **https://youtu.be/Jcx7gv-LaKs**.

The GOES-R series satellites also host a suite of instruments that provide significantly improved detection of approaching space weather hazards. Two Sun-pointing instruments measure solar ultraviolet light and X-rays. The **Solar Ultraviolet Imager (SUVI)** observes and characterizes complex active regions of the Sun, solar flares, and the eruptions of solar filaments which may give rise to coronal mass ejections. The **Extreme Ultraviolet and X-ray Irradiance Sensors (EXIS)** detects solar flares and monitors solar irradiance that impacts the upper atmosphere. The satellites also carry two instruments that measure their space environment. The **Space Environment In-Situ Suite (SEISS)** monitors proton, electron, and heavy ion fluxes in the magnetosphere. The **Magnetometer (MAG)** measures the magnetic field in the outer portion of the magnetosphere. Together, observations from these instruments will enable NOAA's Space Weather Prediction Center to significantly improve space weather forecasts and provide early warning of possible impacts such as radiation hazards, power blackouts, and communications and navigation disruptions.



These images of the Sun were captured at the same time on January 29, 2017 by the six channels on the SUVI instrument on board GOES-16 and show a large coronal hole in the Sun's southern hemisphere. Each channel observes the Sun at a different wavelength, allowing scientists to detect a wide range of solar phenomena important for space weather forecasting. Credit: NOAA/NASA

WHAT IS THE SCOPE OF THE GOES-R GROUND SYSTEM?

NOAA has developed a state-of-the-art ground system to receive data from the GOES-R spacecraft and generate real-time data products. The system is responsible for space/ground communications, raw data processing, monitoring the satellite's health and safety, and commanding the spacecraft and instruments. The GOES-R ground system consists of two primary locations that receive data from the GOES-R series satellites: NOAA Satellite Operations Facility (NSOF) in Suitland, Maryland, and Wallops Command and Data Acquisition Station (WCDAS) in Wallops, Virginia. A third operations facility in Fairmont, West Virginia, serves as the Consolidated Backup (CBU). The new GOES-R ground system will support GOES-R through U and provide antenna capabilities for the existing GOES-N through P satellites. It consists of over 5 million lines of code, over 1100 servers housed in over 250 equipment racks with over 400 workstations located at eight locations, and includes six newly-designed and four refurbished antennas. The system continually processes nearly 0.85 TB of raw sensor data per day, generating 1.75 TB of products, 24/7, with latency requirements as short as 23 seconds.

WHAT ARE THE BENEFITS OF GOES-R SERIES SATELLITES?

The GOES-R series will provide critical atmospheric, hydrologic, oceanic, climatic, solar, and space data, significantly improving the detection and observation of environmental phenomena that directly affect public safety, protection of property, and our nation's economic health and prosperity:

- **Improved hurricane track and intensity forecasts**
- **Increased thunderstorm and tornado warning lead time**
- **Earlier warning of ground lightning strike hazards**
- **Improved transportation safety and aviation flight route planning**
- **Improved air quality warnings and alerts**
- **Better monitoring of smoke and dust**
- **Better fire detection and intensity estimation**
- **Better detection of heavy rainfall and flash flooding risks**
- **More accurate monitoring of energetic particles responsible for radiation hazards tohumans and spacecraft**
- **Increased warning of communications and navigation disruptions due to solar flares**
- **Improved power blackout forecasts**
- **Improved numerical weather prediction models**
- **Better data for long-term climate variability studies**

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The GOES-R series also continues the Search and Rescue Satellite-Aided Tracking (SARSAT) system, which detects and locates mariners, aviators, and other recreational users in distress. The SARSAT system has rescued thousands of people from life-threatening situations throughout the Unites States and its surrounding waters. The GOES-R series SARSAT transponder will operate with a lower uplink power than the current system, enabling the satellites to detect weaker beacon signals.

WHAT IS THE STATUS OF GOES-16?

GOES-16 is currently parked in its checkout location at 89.5 degrees west, undergoing post-launch testing, which will be followed by an extended validation phase. All of the instruments are generating science data, and the ground system is processing and distributing data products. Product validation reviews began in February and preliminary, non-operational data is flowing to direct readout users. By June, NOAA is expected to announce the planned operational location for GOES-16. The satellite will reside in orbit as either GOES East (75 degrees west) or GOES West (137 degrees west) and be fully operational by November.

Preliminary, non-operational data and imagery from GOES-16 can be found at **https://go.usa.gov/xXqKe.**

WHAT'S NEXT?

GOES-S, the next satellite in the series, is undergoing thermal vacuum testing, which simulates the extreme conditions the satellite will experience in space. Thermal vacuum testing ensures that the satellite can withstand the anticipated extreme thermal environment in space. GOES-S is scheduled to launch in spring of 2018, and once operational, will give the U.S. two next-generation geostationary weather satellites to watch over the Western Hemisphere. GOES-T and GOES-U are currently scheduled for launch in 2019 and 2024, respectively. ▲

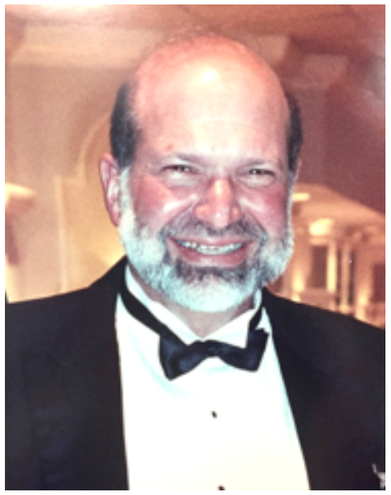
For more information on the GOES-R series, please see **www.goes-r.gov.**

MICHELLE SMITH, CODE 417
GOES-R SERIES PROGRAM
COMMUNICATIONS SPECIALIST

Engineers prepare GOES-S for acoustics testing in November 2016.
Credit: Lockheed Martin

REMEMBERING MARTY DAVIS

"Marty dedicated a significant part of his life enabling our nation's current weather systems to protect lives. His dedication to mentoring the next generation of engineers ensured that his legacy will be continued. Marty was one of those people who made a difference while he was on Earth and left the planet and every one he touched in a better place as a result of his visit. – *Former Center Director Joe Rothenberg*



Marty Davis, a D.C. native and University of Maryland graduate, first came to GSFC in 1962. In his early years on Center, Marty worked as a Power Conversion Engineer on the Atmosphere Explorer-B, Radio Astronomy Explorer, and eight of the Interplanetary Monitoring Platforms (IMPs). He steered his career toward instruments, which he found particularly rewarding, and was appointed Experiment Manager on IMP-H and J, and then Instrument Systems Manager for the International Sun Earth Explorers. From 1978 through 1991, he was Instrument Systems Manager and then Observatory Manager for the Compton Gamma Ray Observatory (GRO), leading its preparations for launch aboard STS-37.

After GRO, Marty was tapped by Rick Obenschain, who was then the Geostationary Operational Environmental Satellite I-M series (GOES-IM) Project Manager, to help rescue its foundering instrument development. Marty conquered the technical and programmatic challenges for the GOES instruments, and took GOES-I to launch in 1994, just narrowly averting the crisis of the U.S. being without a geostationary weather satellite. Marty went on to serve as the GOES Deputy Project Manager and then Project Manager, leading the team through the successful on-orbit delivery of the GOES J, K, L, and M satellites. He also managed the procurement of the next generation series, GOES-NOP, and eventually became the Deputy Associate Director for Earth Science Operational Projects with responsibility for the Polar Operational Environmental Satellites as well. Marty retired in 2009, but he continued supporting GSFC on review teams for the Mars Atmosphere and Volatile EvolutioN (MAVEN) and GOES-R missions through last year.

Marty was one of our Center's most decorated engineers, having been recognized with the Goddard Award of Merit and the NASA Distinguished Service Medal, the highest honors bestowed by the Center and Agency, respectively. He was also the recipient of the NASA Exceptional Service Medal and the NASA Outstanding Leadership Medal.

Marty was a wonderful mentor: he gave his time and advice generously; he helped guide careers by offering wise counsel or a step up at a critical juncture; and his direct, hands-on, in-person, never-say-no management approach became a model to emulate. His philosophy lives on in the generations of engineers and managers that grew up under his guidance.

Marty was an avid follower of local sports and arts, supporting several DC theater companies and attending Ravens and Capitals games and Maryland lacrosse matches. For many years, he and his

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wife of 45 years, Belle, were active members of Goddard's Music and Drama Club. Marty even took a role on stage, starring as Tevye in a 1981 production of Fiddler on the Roof. (You can find Marty's performance of "If I Were a Rich Man" on YouTube.)

Marty and Belle were very close to their extended family, keeping up with the birthdays, Bar and Bat Mitzvahs, and weddings for their 55 nephews and nieces, 115 great nephews and nieces, and four great-great nephews and nieces.

Although Marty was a great engineer and manager, he will be best remembered and most loved for the way he built his projects into a family. Marty took great joy in bringing the team together and in having everyone share in the project's success. He founded the annual GOES Crab Feast and the Space Golf Tournament; he took team members to plays and baseball games; sponsored bowling nights, softball games, canoe trips, and dinners. Most importantly, he made sure that everyone was there at the end of all of their hard work to see the satellites launch. For Marty, the people were always the most important part of the job. ▲

PAM SULLIVAN, CODE 417
GOES PROJECT MANAGER

Tributes to and stories about Marty, from his co-workers and friends.

"In trying to solve the knotty GOES-IM instrument problems, Marty realized he needed to solve an underlying organizational problem: he needed to get the two major companies responsible for GOES to work together and not in opposition. So one day in Fort Wayne, Marty was driving past a hardware store that was using an elephant, an actual live elephant, for some sales promotion. Only Marty would see an elephant and think, "Aha, team building exercise!" Not taking no for an answer, Marty got the two managers from the two companies on top of that elephant together. I can still remember the looks on their faces. It was funny, but from that point, those two managers knew that they could not ignore each other, nor Marty's drive to make the team succeed."

"After first joining GOES, I came in one weekend afternoon to get my office situated. As soon as the second floor elevator door opened, I was enveloped by the smell of someone smoking a cigar. As I looked around for the perpetrator of this flagrant violation of Center policy, I came to the project suite and Marty's office. He was sitting at his conference table surrounded by an assortment of cut meats, cheeses, a bottle of wine, and an ashtray. He invited me in and we spent the next several hours solving the problems of the world. From then on, if the elevator door opened on a weekend and I didn't smell cigar smoke, I was very disappointed."

"Marty was like a second father to me. He was always someone who listened intently and always provided sound advice, whether it be personal or business related. Marty taught me the true meaning of dedication and commitment to NASA projects. He knew exactly what it took to be successful and provided guidance to that end. Marty also traveled a great distance to a mountain top in Camden, Maine where he and Belle shared in a very special moment in my life – my wedding day. Marty was a true friend. I will him miss dearly."

"Being on GOES I-M involved a lot of travel. The instruments were being built in Fort Wayne, the spacecraft integrated in Palo Alto and launch campaigns at the Cape always being planned or executed. One of the best things about those years of TDY, was being able to go out and eat with Marty so often. Countless BBQ pits, sushi bars, noodle joints, pizza places, steak/seafood houses were the venues for his great stories and his gentle mentoring/guidance that I'll never forget. I truly miss the sparkle in his eye, those big red cheeks when he laughed and his kindness and common sense."

"Marty was a very inclusive person, great at what he did and yet humble. It was during the first week of my employment on GOES when I left my oatmeal bowl to soak in the sink in the corridor and he washed and dried it and brought it to me. Needless to say I was so embarrassed that the PM washed my dish and with that big broad smile he had and said: there is nothing to be embarrassed for, if you see my dishes or someone else's, you can do it, we are a team. He gave me opportunities to try myself in different roles, trusted my judgement and help me grow."

"My education on spacecraft and instrument development, project management, and working with external partners came primarily from the "School of Marty Davis." I have much to be grateful for. He took so many others under his wing as well in both formal and informal mentoring relationships. These "Marty mentees" are now sprinkled throughout the Goddard Space Flight Center. In my view, more important than the hardware, Marty has planted seeds of knowledge with people over the span of several decades that will bear fruit at Goddard for many years into the future. Thank you Marty for your leadership, mentorship, and friendship."

GODDARD MEMORIAL SYMPOSIUM

As many of you are well aware, NASA's Goddard Space Flight Center lost four of its greatest minds in the past several months. Phil Sabelhaus, Marty Davis, Neil Gehrels and Piers Sellers made indelible contributions to space exploration during their decades of service to NASA and Goddard. At a recent Goddard Memorial Symposium, Center Director Chris Scolese presented a video honoring the legacies of these individuals and their lasting impact on the Goddard community.

A TRIBUTE TO
PHIL SABELHAUS

Phil Sabelhaus was one of a kind, and he won't soon be forgotten by those of us who had the pleasure and privilege of knowing and working with him. Needless to say, his office attire alone was the stuff of legends, consisting of tee-shirts, shorts, and flip-flops whenever weather permitted, and his beard and long hair were throwbacks to the scruffy sixties. Two of his favorite pastimes were dog-walking and surfing, and his favorite vacation spot was Maui.

But Phil's casual outward appearance and his hang-loose pastimes belied his disciplined, no-nonsense approach to project management. In fact, Phil's tremendous management accomplishments are woven through countless NASA projects and programs, and, for more than 30 years, Phil undertook some of NASA's most challenging tests of leadership.

Phil graduated from the University of Maryland with a B.S. in Mechanical Engineering in 1978. He then came to work at GSFC in the Instrument Systems Analysis Branch, where he performed structural analysis on spacecraft instruments. In 1981, Phil briefly left GSFC and went to work as the Launch Vehicle Integration Manager for GTE Spacenet Corporation. During his time there, he successfully managed the launch vehicle integration activities for three communications satellites that were launched on Ariane launch vehicles from French Guiana in South America.

Phil returned to GSFC in the summer of 1985 and lent his talents as a systems engineer to the early years of the Space Station program, which was an untested concept in the 1980s that flourished into an international, collaborative engineering marvel decades later. In 1989, Phil transitioned into GSFC's Flight Projects Directorate where he began an impressive string of successes in the following positions: Flight Telerobotic Servicer (FTS) Project Deputy Project Manager, Total Ozone Mapping Spectrometer (TOMS) Project Manager, GOES Deputy Project Manager, Landsat 7 Project Manager, Aura Project Manager, Vegetation Canopy Lidar (VCL) Project Manager, Aqua Project Manager, and Earth Observing System (EOS) Program Manager.

Perhaps the most daunting challenge of Phil's career came in 2002, when he took the helm as the Project Manager of the James Webb Space Telescope (JWST) Project, one of NASA's premier observatory missions and one of GSFC's largest and most complex projects. During his tenure as the JWST Project Manager, Phil managed a multi-billion dollar budget under extremely tight cost constraints, and he advanced the cutting-edge progress of 12 critical, high-risk, "enabling" technologies. Under his leadership, the project team achieved all mission milestones while developing and strengthening countless domestic and international partnerships.

In 2010 Phil returned to his Earth Science roots as the Landsat Data Continuity Mission Project Manager. Once again, flight hardware deliveries were realized, critical launch milestones were met, and the project remained on track.

Phil retired from GSFC in 2012, but returned as a contractor, first as a Systems Engineer/Manager with the Hawk Institute for Space Studies, and later as a Principal Engineer with Stinger Ghafferian Technologies. In these roles, Phil once again provided support to numerous GSFC projects, including GOES-R, JPSS Flight 1 and Landsat 9.

In Phil's numerous leadership roles, he treated his project team as his family. And, like the head of any family, Phil shared the pride of success when things went right, and he accepted the burden of failure when things went wrong. But he invariably preferred solutions over excuses, and he inspired a new generation of future managers to do the same.

Phil was honored with many notable awards, including the Senior Executive Service Presidential Rank Award, the William T. Pecora Award, the Nelson P. Jackson Award, two Aviation Week and Space Technology Awards, several NASA Outstanding Leadership Awards and, finally, the NASA Distinguished Service Medal, which is the highest award bestowed by NASA.

Phil was born in Manhattan, Kansas, but for most of his life he was a resident of Maryland. He was a proud graduate of the University of Maryland, and, to prove it, he had a prominent image of the school's terrapin mascot tattooed on his leg. Phil is survived by his wonderful wife of 42 years, Sharon, his two lovely daughters, Jeni and Amy, and a large extended family.

Phil also leaves behind an amazing ledger of notable NASA accomplishments, as well as a large extended family of NASA colleagues whose lives he touched and who will carry his legacy of leadership forward in all of their future NASA endeavors. ▲

JOHN DECKER, CODE 400
FPD EMERITUS ADVISOR

MAUREEN DISHAROON, CODE 443
JWST DATA SYSTEMS MANAGER

DID YOU KNOW...?

Did you know... that in December 2000, Congress passed a law (Public Law 106-579) asking Americans to pause at 3 p.m. local time for one minute on Memorial Day to remember and honor those who died in service to the United States? The act of national unity is called the Memorial Day National Moment of Remembrance.

We want to be in the know! If you have something to share, please send it to Code 400 Diversity and Inclusion Committee, c/o Matthew Ritsko at: matthew.w.ritsko@nasa.gov and we'll include it in a future issue of the Critical Path.

MODERN FIGURES

The film *"Hidden Figures,"* based on the book by Margot Lee Shetterly, focuses on the stories of Katherine Johnson, Mary Jackson and Dorothy Vaughan, African-American women who were essential to the success of early spaceflight. The author, Margot Lee Shetterly, and the film's director, Ted Melfi, were recently honored at NASA Headquarters with NASA's Exceptional Public Achievement Award.

"Progress is driven by questioning our assumptions and cultural assumptions. Embracing diversity and inclusion is how we as a nation will take the next giant leap in exploration."

- Former NASA Administrator, Charles Bolden

Acting Administrator, Robert Lightfoot, praised the film: "We are especially fortunate in recent months to have been able to call everyone's attention to the achievements of women of color in past years at NASA through the book and film *Hidden Figures,* and to recognize the contributions of the Modern Figures of today. In fact, on International Women's Day ..., we celebrated with a virtual tour that brings students into the exciting careers of seven women in science, technology, engineering and math (STEM) fields at the Agency. This Modern Figures tour introduced several amazing women who are contributing to America's space program today."

Recently, Flight Projects Directorate (FPD) Deputy Director for Planning & Business Management, Wanda Peters, joined three other panelists, Christyl Johnson, GSFC Deputy Director, Cynthia Simmons, Chief of the GSFC Instrument Systems and Technology Division (ISTD) in the Applied Engineering and Technology Directorate (AETD) and Dr. Mamta Nagaraja, NASA Headquarters, at NBC Universal for a wide-ranging discussion on Modern Figures, moderated by NBC's Barbara Harrison.

Wanda Peters shared her thoughts following the discussion: "The Black Employees Network @ NBCUniversal, in conjunction with Comcast, sponsored the "Modern Figures" panel as a part of their Black History Month activities. I was asked to share my experiences as an engineer at NASA and to encourage the next generation of young women and men who may be interested in pursuing a career in STEM. It was truly an honor to be recognized as a Modern Figure at NASA, following the footsteps of some truly amazing women. Prior to the release of the book, "Hidden Figures", I was unaware of these dynamic women's story. Their legacy is inspirational. In many ways, I can relate to and appreciate their journeys. Being able to work at NASA and contribute to the success of several missions is truly a blessing. I was humbled to have the opportunity to share my passion for science, technology, engineering and math. It excites me to see young people's eyes light up when I share my experiences. Christyl, Cynthia, Mamta, and I had a wonderful time talking about our STEM journey and the people who inspired us. I am privileged and honored to be a member of the "Modern Figures" community."

The complete interview (which is over 50 minutes) can be viewed at:
https://www.facebook.com/nbcwashington/videos/10155192967363606/?hc_ref=PAGcES_TIMELINE

Angela Mason, Mission Manager, Earth Science Projects Division (Code 420) and a member of the FPD Diversity and Inclusion (D&I) committee, has a personal connection to the film. She says, "If you haven't seen *Hidden Figures* yet, you are in for a treat. The movie is awesome!!! This movie is so personal to me. I lived with the late Mary Jackson (Janel Monet plays her role) and her family when I first started my career. Being so young and away from home, the Jacksons made me a part of their family. Mary's husband Levi (Jack) taught me how to cook. I also have the pleasure of knowing Dr. Katherine Johnson (Taraji P Henson plays her role) and her husband, Jim. We were a part of the National Technical Association where we hosted all kinds of STEM outreach events for grades K-12 and college students in the Hampton Roads, Virginia area. I met the author of the book *Hidden Figures,* Margot Lee Shetterly, last summer, but I know her parents, Robert B. Lee (retired from NASA Langley), and his wife, Margaret Lee, who edited my thesis for my Master's Degree. This movie, *Hidden Figures*, is truly personal to me."

Angela with Mary Jackson and Wanda Jackson in 1985

Angela was interviewed by Fox 5 News on January 12, 2017. Her interview with anchor Shawn Yancy can be seen at the link below:
http://www.fox5dc.com/news/229064253-video

For more information on the Modern Figures / Hidden Figures connection, go to: **nasa.gov/modernfigures** as well as the Women@NASA site at **women.nasa.gov** to enjoy the ongoing documentation of women's stories at NASA.

Angela with Katherine Johnson on her 98th birthday, August 2016

Angela and Katherine Johnson at unveiling and dedication of bench and historical marker, August 2016

Angela with Hidden Figures author Margot Lee Shetterly

HSIAO SMITH

Hsiao serves as the Technical Deputy Division Manager for the Satellite Servicing Projects Division (SSPD). SSPD continues the legacy of the five successful Hubble Space Telescope Servicing Missions and is now advancing the state of the art in robotic servicing by developing the necessary technologies, managing missions, and transferring servicing capabilities to industry. At SSPD, Hsiao is responsible for technical management, coordination, and implementation of satellite servicing technologies and capabilities for SSPD. Hsiao is proud to be a part of an innovative team dedicated to advancing satellite servicing for NASA.

BORN:

Johor Bahru, Malaysia

EDUCATION:

BS Electrical Engineering
University of Maryland, College Park

MS Engineering Management
University of Maryland University College

LIFE BEFORE GODDARD:

As an immigrant from a different culture who grew up speaking another language, Hsiao had no idea that she would one day work for NASA. She started working at Goddard when she was in high school through the Junior Fellowship Program, and this internship experience inspired her to become an engineer. Goddard opened the door for many meaningful and challenging work opportunities, and lasting friendships and relationships. It is here where she met her husband, where her children attended Pre-school and Kindergarten, and where she met many of her close friends.

LIFE AT GODDARD:

Starting as a Junior Fellow while still in high school, Hsiao never could have imagined that a summer internship would change her life and lead to an illustrious career at a place that would become more than just a workplace, and more like a family. For Hsiao, working at Goddard is rewarding not only because of the dynamic and challenging projects, but also because she has the opportunity to work alongside people who are world-class experts in their fields and passionate about what they do.

Hsiao received a Bachelor of Science degree in Electrical Engineering and a Master of Science degree in Engineering Management from the University of Maryland. From there, she started full-time at Goddard, and has been here

HSIAO SMITH

since. Her first full-time position was serving as the Power Systems Engineer designing high voltage power supplies for the WIND and Polar instruments. She then worked on spacecraft power systems for the Rossi X-Ray Timing Explorer (XTE) Project from design development, to integration on the spacecraft, to then supporting the launch. After the XTE launch, she joined the Hubble Space Telescope (HST) Project serving as the Power System Manager, then she joined the instrument team as the COS Instrument Manager and later served as the HST Servicing Mission 4 Instrument Systems Manager. After HST, she worked as the Lunar Laser Communication Demonstration (LLCD) Project Manager. In the last few years, she worked on Joint Polar Satellite Systems (JPSS) serving first as the Study Manager and later as the Deputy Program Manager for Technical. In February 2017, Hsiao started with SSPD in the position she currently holds.

In addition to her responsibilities as Technical Deputy Division Manager, Hsiao is also a strong advocate for NASA's educational outreach programs, in large part due to the start of her career at Goddard. She is involved with outreach activities for students and summer interns, and also acts as a Flight Project Development Program (FPDP) mentor. Hsiao is also committed to diversity; she is a member of the Asian Pacific American Advisory Committee (APAAC) and is also an ad hoc member of the Code 400 Diversity & Inclusion Committee.

LIFE OUTSIDE OF GODDARD:

Hsiao is married and has a son and daughter, both of whom currently attend Virginia Tech. She loves travelling to Caribbean islands that are off the beaten path. "I enjoy traveling because it expands my awareness of greater diversity, connects me to cultures and people, and enlightens me about the living things in our environment." She enjoys snorkeling, walking on the beach, sailing, biking, and spends most of her spare time cooking for her family and friends. She is passionate about home remodeling and is always working on some on-going home project. ▲

"I enjoy traveling because it expands my awareness of greater diversity, connects me to cultures and people, and enlightens me about the living things in our environment."

-Hsiao Smith

BEHIND THE BADGE

BRIAN THOMAS

Brian Thomas is part of Cohort #2 for the Flight Projects Development Program (FPDP).

BORN:

Memphis, Tennessee

EDUCATION:

Bachelor of Arts, Economics, Cornell University

LIFE BEFORE GODDARD:

Brian grew up in Memphis, Tennessee, where he played competitive soccer and hockey and captained his high school hockey team to a state championship. He attended Cornell University, where as a freshman, he played Club Hockey and was a Spring-semester team member of the Cornell Racing FSAE team. Unfortunately, the summer after his freshman year, Brian suffered a cervical spinal cord injury from a diving accident in a residential swimming pool. He spent a year undergoing physical rehabilitation and was able to return to Cornell, graduating in 2009. He was hired by GSFC during his senior year and moved to Maryland after graduation.

LIFE AT GODDARD:

Brian joined NASA in August 2009 as a resources analyst (RA) in the Institutional Support Office, Code 201, within the Management Operations Directorate (MOD). Throughout his time as an RA in Code 201, he supported the Information and Logistics Management and Facilities Management Divisions. In 2011 Brian was honored with a Robert H. Goddard award for exemplary cost saving actions to the MOD budget. During his last year in Code 201, he was detailed as the Business Management Officer supporting the Procurement Operations Division, Code 210, working with division management on acquisition process improvement and personnel management initiatives. In 2014 Brian transitioned to the Flight Projects Directorate as the senior resources analyst for the Earth Science Data and Information Systems (ESDIS) project, Code 423, providing a broad range of financial analysis and support for all aspects of the project while collaborating with ESDIS counterparts in Code 600 and at

"I have come to learn that effective resource management is really more system engineering than accounting. It is about understanding and managing component resources to get the right product, at the right cost, on the right schedule. This mindset is essential to facilitate the dynamic approach necessary for today's budget environment.

-Brian Thomas

BEHIND THE BADGE

BRIAN THOMAS

other NASA centers. In April 2016, Brian was selected for the Flight Projects Development Program (FPDP). His first of two one-year work assignments is with the Satellite Servicing Projects Division (SSPD), Code 480, as a program, planning, and control (PP&C) analyst, primarily supporting the financial management of the Asteroid Redirect Robotic Mission Capture Module (ARRM-CAPM) project, a GSFC-led partnership with the Jet Propulsion Laboratory and Langley Research Center, during Phase A/B activities. The ARRM-CAPM environment is dynamic and a great experience. Brian is looking forward to his next challenging work assignment that is set to start in May. From 2010 to 2014, Brian was a member of the Equal Accessibility Advisory Committee (EAAC).

LIFE OUTSIDE OF GODDARD:

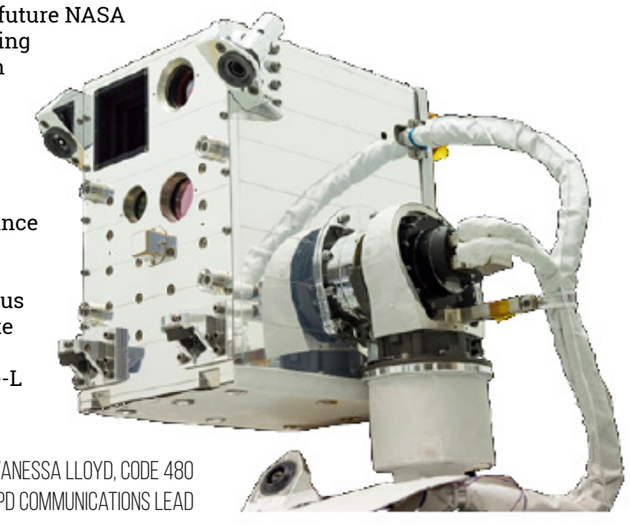
Brian lives in Elkridge, Maryland with his wife Jen, son Connor, and dog Dudley. He is an avid fan of motor racing, soccer, and hockey, particularly Formula 1 racing and top flight English soccer, the English Premiere League (EPL). His favorite EPL team is Liverpool FC, and he supports the Washington Capitals. Brian spends most of his free time doing activities with his two year old son. He likes to stay active by playing recreational tennis and generally enjoying the outdoors. During his down time, he enjoys reading automotive magazines and playing racing video games. ▲

RAVEN

Launched on February 19, 2017, aboard the tenth SpaceX commercial resupply mission, was a technology module called Raven which will bring NASA one step closer to having a relative navigation capability. When affixed outside the International Space Station, Raven will test foundational technologies that will enable autonomous rendezvous in space, meaning they will not require any human involvement—even from the ground.

During its stay aboard the space station, Raven's components, including sensors, a high-speed processor, and advanced algorithms, will join forces to independently image and track incoming and outgoing visiting space station spacecraft. While Raven works, NASA operators on the ground will evaluate how Raven's technologies work together as a system, and will make adjustments to increase Raven's tracking performance.

Over its 2-year lifespan, Raven will test these critical technologies that are expected to support future NASA missions for decades to come. One upcoming application for this technology is its use in the Restore-L servicing mission which will navigate to refuel Landsat 7, a U.S. government Earth-observing satellite already in orbit. An additional application is the potential use for systems on NASA's Journey to Mars. Raven is on track to advance and mature the sensors, machine vision algorithms, and processing necessary to implement a robust autonomous rendezvous and docking system for NASA. The Satellite Servicing Projects Division is developing and managing both the Raven and Restore-L demonstration missions. ▲



VANESSA LLOYD, CODE 480
SSPD COMMUNICATIONS LEAD

CRITICAL PATH **NEWS UPDATE**

JOHN DURNING AND JULIE VAN CAMPEN

John Durning and his donor Julie Van Campen at Goddard Space FLight Center

In the Winter 2016 publication of The Critical Path, John Durning, Deputy Associate Director/ Technical for the James Webb Space Telescope (JWST) project, described the medical journey he was about to take with fellow co-worker, Julie Van Campen (JWST ISIM Lead Systems Engineer). John has a genetic condition known as Polycystic Kidney Disease (PKD), an inherited disease that causes many cysts to form in the kidneys. The latter stage of the disease requires either dialysis or a kidney transplant. In mid-December 2016, John underwent a successful transplant surgery to receive a healthy kidney through a paired donation program, and Julie's surgery to donate hers occurred in late December. Here's a follow-up from John and Julie describing the organ transplant process:

"Hello again. When last we communicated, Julie Van Campen and I were preparing for a kidney transplant where Julie most generously was going to give me one of her kidneys. A lot has happened since then.

"Before I get into our medical status, here is a little background. Your body has antigens, markers that uniquely identify you. Your immune system scours your body 24 hours a day, 7 days a week, 365 days a year for as long as you live, looking for organisms and checking antigens of each organism to make sure these organisms belong to you. When the immune system finds an organism that does not have antigens that match yours, it marks it and sends an alarm that notifies your white blood cells to attach and destroy the foreign organism. If that organism happens to be your new kidney, you are in deep trouble.

"There are six key antigens that play a major role in organ transplants. When looking for compatible matches for kidney transplants, the doctors look for antigen matches between the donor and recipient. Maximizing the matches (a 6 out of 6 antigen match is ideal and conversely a 1 out of 6 antigen match is not) provides the best potential for the recipient's body to accept the new kidney.

> **"The kidney performance is excellent – I am very fortunate. Julie's recovery has been exceptional.**

"Why am I telling you all this? Well, Julie and I are a 2 out of 6 antigen match. A good match but not a great match. In order to improve my odds, Julie was willing to consider entering into the Paired Exchange program with me. The Paired Exchange program is run by the National Kidney Foundation where the pair – donor and recipient – register into a database of like-minded pairs. The foundation executes an algorithm that searches the database trying to find the best antigen matches for everyone in the database. Through that paired program, the system found a 5 out of 6 antigen match for me and Julie was able to donate to someone whose pair had no match with them. So it was a win-win situation.

"I had my surgery on December 15 and my kidney came from a donor in San Francisco. Julie donated her kidney to someone in Ohio at the end of December. My kidney arrived on the morning of my surgery, carried in the cargo bay of a commercial airliner's redeye flight in a cardboard box marked "left kidney." (This is the standard way of delivery so all of you folks who travel on a redeye for some of your work trips may share the flight with an organ stored in the plane's cargo bay, destined to give someone like me a new lease on life.)

"After a recovery period of 10 weeks to allow my body to adjust to its new addition and get the correct "cocktail" of anti-rejection drugs, I returned to work. The kidney performance is excellent – I am very fortunate. Julie's recovery has been exceptional. Each day I get stronger and, hopefully, after 6 months I will be cleared to travel. I have to take anti-rejection drugs for the rest of my life but that seems a small price to pay to be able to have a long-term outlook on life."

Julie's recovery was exceptionally quick and she feels 100% normal, post-surgery. As a matter of fact, she went hiking 3 days after her surgery. Julie commented, "Next winter, if I had the choice between getting a bout of the flu or donating a kidney, I'd choose to donate a kidney again." Obviously, Julie will be keeping the one kidney she has left but she was surprised at how fast she returned to a normal routine. She also added, "You might not think about your kidneys much. Everyone hears about their cholesterol hurting their heart, smoking destroying their lungs, drinking poisoning their liver – but not much on your kidneys. The best thing you can do to make sure that you don't do needless harm to your kidneys is to maintain a healthy weight with an active lifestyle. High blood pressure and diabetes can cause kidney failure, too. Unless you are super unlucky, as John was, to inherit a devastating kidney disease, your kidney health is something you can control. Being healthy doesn't have to be hard – but your life (or someone else's) may depend on it."

Both John and Julie jumped back into their work life, doing what they do best—lending their talents and expertise to the JWST project as NASA's next premier observatory moves closer to its launch in 2018. They have enjoyed their own mission success through the kidney donation program and look forward to witnessing the same for JWST. ▲

For more information on kidney donation, please visit the National Kidney Foundation website at: **https://www.kidney.org**

Please consider donating the gift of life when you renew your driver's license. For more information, go to: **http://www.mva.maryland.gov/programs/organ-donors/**

MAUREEN DISHAROON, CODE 443
JWST DATA SYSTEMS MANAGER

WHAT IS THE NASA PPM CERTIFICATION?

In April 2007, the Office of Management and Budget (OMB) announced a set of mandatory certification requirements for civilian-agency program and project managers. In response, the NASA Academy of Program/Project and Engineering Leadership (APPEL) program office developed a process to certify NASA flight program and project managers (PPMs) who meet the rigorous competency requirements and who are managing (or will potentially manage) projects with lifecycle costs greater than $250 million as defined in NPR 7120.5.

NASA has determined that individuals must be proficient in 32 project management related competencies. Eleven of the 32 competencies are "common" competencies established by the OMB. The remaining 21 competencies are determined to be critical for individuals managing NASA flight programs and projects.

Candidates for the NASA PPM certification are nominated and vetted through their respective Center PPM Review Boards. Once approved by the Center Director, the list of nominees is sent to the NASA Office of the Chief Engineer (OCE) for final endorsement. If the OCE concurs, they generate a certification letter and a certificate for the candidate. The OCE sends the certificate to the Centers for distribution.

Once certified, a NASA PPM is required to meet continuing educational requirements to ensure that they remain current on emerging technologies, standards, and practices. To recertify, NASA PPMs are required to obtain 80 continuing education units every two years.

NASA currently certifies 161 PPMs, and 103 of those are GSFC employees! In February 2017, GSFC presented NASA PPM certificates to eight newly certified PPMs. Please join us in congratulating Robert (Bob) Caffrey, Elizabeth Forsbacka, Ferzan Jaeger, Mark McInerney, Andrew Mitchell, Wanda Peters, Carrie White and Donald (Don) Whiteman on their accomplishment!

For more information on the NASA PPM certification requirements, please refer to the following link: **https://appel.nasa.gov/curriculum/fac-ppm-certification/**

For more information on the competency requirements, please refer to the following link: **https://fpdspi.gsfc.nasa.gov/sites/400/400fpdoffice/FPD/SiteAssets/SitePages/PM%20Certification/NASA%20FAC%20PPM%20Competencies%202.pdf**

Dave Mitchell, Andrew Mitchell

Dave Mitchell, Mark McInerney

Dave Mitchell, Wanda Peters

Dave Mitchell, Don Whiteman

CECILIA CZARNECKI / CODE 400
FPD ASSISTANT DIRECTOR

ARCTIC CONNECTIONS

Since the start of the new year, three NASA missions, including five sounding rockets, have launched from the Poker Flat Research Range (PFRR) outside Fairbanks, Alaska. These Heliophysics missions hope to study the interactions of the solar wind with Earth's upper atmosphere and ionosphere through observing and collecting data on aurora and aurora-related atmospheric phenomenon. These launches coincided with the release of a new Iñupiaq-based curriculum on aurora from the University of Alaska Fairbanks' Geophysical Institute (GI) and the North Slope Borough School District (NSBSD). Aaluk Edwardson, an InuTeq employee on the PAAC IV contract at NASA Headquarters, coordinated a panel discussion hosted by NASA, the GI and NSBSD for ASRC shareholders from across the North Slope to engage with NASA science and technology and Iñupiaq culture through the study of aurora. The event was held as a part of one of the largest cultural events on the North Slope, Kivgiq; Kivgiq is only held once every few years. The panel included cultural experts on aurora and Arctic science, two NASA rocket scientists, a representative from a NASA-affiliated citizen scientist organization called Aurorasaurus, members of the North Slope Borough School District, and the NASA Heliophysics Director from NASA Headquarters. The event connected NASA with students and educators from all over the Arctic and was part of an effort to build the science, technology, engineering and mathematics (STEM) pipeline between Arctic students and Arctic science. The event was broadcast across the North Slope for village shareholders to experience and participate in as well.

Girls dancing at Kivgiq

Arctic Ocean

NASA Heliophysics is working with NASA Earth on future events in Alaska that connect students and communities to NASA science and research done in the Arctic. NASA Heliophysics is also working with the University of Alaska Fairbanks on future Arctic science research collaborations to support education and access to technology for the residents of the North Slope of Alaska.

AALUK EDWARDSON, HELIOPHYSICS DIVISION
SCIENCE MISSION DIRECTORATE, NASA HQ

'Twas the Nightmare Before Building 36

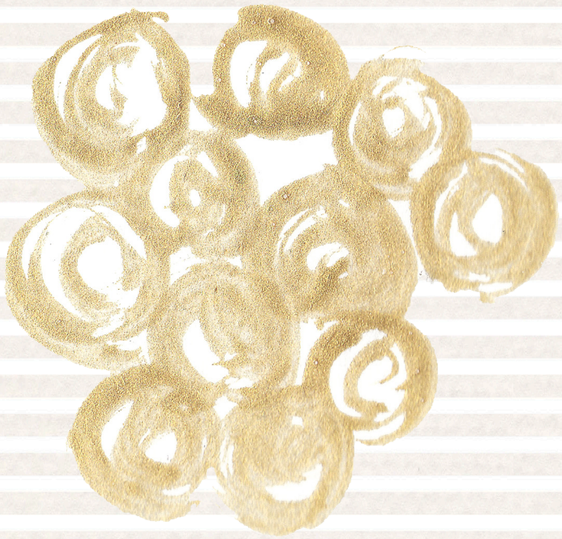
'Twas the night before move day, and all through the place,
employees were packing at a furious pace.
The boxes were taped up and labelled with care,
knowing the movers soon would be there.
The POCs were all anxious, so much stuff in their heads,
wishing they were chillin' in the Bahamas instead.

And Eva in her hardhat
and me in my vest,
had just completed
a walkthrough
of Building 36.

Continued on page 30

CONTINUED FROM PAGE 29

When out of Code 100, there arose such a rumpus,
Who knew they'd move in and would partially bump us?
We scheduled a meeting to discuss with the POCs,
We'd make this work out, **BECAUSE 400 ROCKS!**
We resolved to push through and to make lemonade,
And when all's said and done, great tenants they made!



Dinosaurs, furloughs and weather galore,
Had us wondering if we could take any more!
Then what to my chaotic mind should appear,
But a deep sense of gratitude for how we got here.

Thanks Donna and Katy, Karla, Lori and Bev,
Amanda, and Bill, Nancy, Kelly and Kev,
Your cooperation was epic!
Your support was immense!
You offered new perspective
WHEN THINGS GOT TOO TENSE!

We thank Code 100

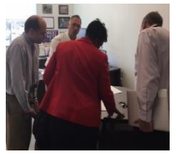
for seeing this through!
Cheers Code 400 management
for your support too!
And Code 200 for all that you do!
Designing, constructing
and outfitting, too!
You built a fine building
and for that we thank you!

Thanks Amy and Dave, Katie, Darlene, and Sara,
Jenny and Irene– we could be such a terror!
And Marla and Terri, we can't forget you!
And, for Dan the Man, we're SO grateful too!
And you'll hear us exclaim as we settle our bones,

WE'RE LOVING AND ROCKING OUR NEW HOME, SWEET HOME!

(Left to Right) Katy Mikkelsen (420), Nancy Dixon(421), Amanda Majstorovic(401), Kelly Catlett (429), Donna Bird (460), Karla Kahler (490), Kevin (Kev) Maloney (460), Bev Coggins (448), Bill Hensley (448) and Lori Dellagatta (420)

Cecilia Czarnecki / Code 400
FPD Assistant Director



WELCOME TO BUILDING 36

The ribbon cutting ceremony for the Flight Projects Building (36) was held on February 22, 2017, and was attended by many. After more than 7 years of planning and execution, this bright and airy building will provide a new home for the Advanced Concepts and Formulation Office (Code 401), the Earth Science Projects Division (Code 420), the Polar Operational Environmental Satellite projects (Code 421), the Landsat 9 Mission Office (Code 429), the Wide-Field Infrared Survey Telescope Project (Code 448), the Explorers and Heliophysics Projects Division (Code 460), and the Instrument Projects Division (Code 490). The Code 100 offices of the Director are temporarily occupying the second floor while renovations are carried out to the Code 100 suite in Building 8.

The new building has open-style offices and conference rooms, and includes the Rick Obenschain Symposium and Conference Room on the second floor, in honor of our former Deputy Center Director. This beautiful symposium room can accommodate up to 100 people, and has teleconferencing and ViTS capabilities, as well as three overhead projectors and NASA and guest wireless network. ▲

CECILIA CZARNECKI / CODE 400
FPD ASSISTANT DIRECTOR

October 1, 2016 through March 31, 2017

COMINGS

LAVIDA D. COOPER (from 566) to 450.2/Technology Enterprise and Mission Pathfinder Office (TEMPO), Office Chief

E. C. GRIGSBY (from 599) to 410/ GOES-R Program, Deputy Program Manager

CECELIA DANIELS HARROD (from 159) detailed to 408/Satellite Servicing Capabilities Office (SSCO), Senior Resources Analyst

JOHN O. BRISTOW (from 581) to 450/Exploration & Space Communications (ESC) Projects Division, Contracting Officer Representative

RONALD J. SIGRIST (from 581) to 450/ ESC Projects Division, Contracting Officer Representative

ANGIE HEWITT (external hire) to 410/ Geostationary Operational Environmental Satellite (GOES)-R program, Consultant

VIR THANVI (from 581) to 458/ Space Network Ground Segment Sustainment (SGSS) project, Project Integration Manager

GREGORY W. HECKLER (from 566) to 458/Tracking & Data Relay Satellite (TDRS) Project Office, Deputy Telecommunications Systems Manager

NEIL F. MARTIN (from 381) detail to 401/Advanced Concepts & Formulation Office, Instrument Capture Project Manager

ALICIA R. JOSE (from 5600) detail to 400/Flight Projects Directorate Secretary

GOINGS

ROBERT C. MIARA retired from 460/Explorers & Heliophysics Projects Division, Project Support Specialist

ADA C. LORIMER (from 453) transferred to Langley Research Center

JANICE L. BUCKNER retired from 407/ Earth Science Technology Office, Technology Program Manager

FRANK J. CEPOLLINA (from 480) retired from SSPD, Associate Director

DAWN R. LOWE (from 423) retired from ESDIS project , Project Manager

LINDA A. GREENSLADE (from 470) retired from JPSS Program, Program Business Manager

CAROLYN L. ELLENES (from 428) retired from 428/Earth Science Mission Operations (ESMO) project, Deputy Project Manager-Resources

APRILLE J. ERICSSON (from 491) to 550/Aerospace Engineer, AST, New Business Lead

JAYA BAJPAYEE (from 401) to Ames Research Center, Deputy Director for Science

JACKLYN C. MATTSON (from 408) retired from 408/SSCO, Project Support Manager

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COMINGS

DAWN R. LOWE (from 423) (external hire) to Earth Science Data and Information Systems (ESDIS) project; Rehired Annuitant/ Consultant

LINDA A. GREENSLADE (from 470) (external hire) to Joint Polar Satellite System (JPSS) Program, Rehired Annuitant/Consultant

FRANK J. CEPOLLINA (from 480) (external hire) to Satellite Servicing Projects Division (SSPD), Rehired Annuitant/Consultant

KEITH A. CHAMBERLIN (from 381) detail to 450/ESC Projects Division

DAVID G. LARSEN (from 224) to 453/ Near Earth Network project, Deputy Project Manager

SUSAN R. BREON (from 540) to 490.2/ Astro-H Recovery Mission/Soft X-ray Spectrometer instrument project, Instrument Project Manager

GOINGS

TOM J. VENATOR (from 483) retired from 483/Restore-L project, Observatory Manager

EILEEN T. GROVES (from 403) retired from 403/Flight Projects Directorate, Business Management Office, Financial Manager

PATRICIA M. FOGLEMAN (from 407) retired from 407/Earth Science Technology Office, Program Support Manager

STEVEN J. DOBROSIELSKI (from 417) retired from 417/GOES-R project, Financial Manager

MICHAEL W. RACKLEY (from 452) retired from 452/Space Network project, Supervisory-Deputy Project Manager

REASSIGNMENTS, REALIGNMENTS & DETAILS WITHIN CODE 400

SERGEY KRIMCHANSKY (from 420) to 424/Total and Spectral Solar Irradiance Sensor (TSIS) project, Deputy Project Manager

VANESSA SOTO MEJIAS (from 433) to 448/Wide Field Infra Red Survey Telescope (WFIRST) Project Office, FPDP-2 - Administrative Manager

ELIZABETH M. FORSBACKA (from 453) to 448/ WFIRST Project Office, Observatory Manager

MELLANI EDWARDS (from 420) to 490/Instrument Projects Division, FPDP-2 – Administrative Manager

LAURA J. MILAM-HANNIN (from 400) to 401/Advanced Concepts & Formulation Office, Associate Director for Formulation

JOHN T. VANSANT (from 401) to 400/Flight Projects Directorate, Associate Director

MILES C. GLASGOW (from 451) to 450.2/Technology Enterprise and Mission Pathfinder Office, Financial Manager

MONIQUE BEIQUE (from 408) to 474/JPSS Ground project, Resources Analyst

ARLIN BARTELS (from 433) to 444/ Space Science Mission Operations (SSMO), OSIRIS-Rex Deputy Project Manager

WEN-TING HSIEH (from 401) to 490/Instrument Projects Division, FPDP-2 - Technical Engineer Operations Management

WANDA PETERS to 400/Flight Projects Directorate, Deputy Director for Planning & Business Management

JACQUELINE F. FERGUSON (from 474) to 450.1/Networks Integration Management Office, Resources Analyst

CARLA E. CONNOR to Explorers & Heliophysics Projects Division, Deputy Program Business Manager

JOY W. BRETTHAUER (from 450) to 460/Explorers & Heliophysics Projects Division, SMEX Mission Manager

CHRISTOPHER M. GRAU (from 443) to 460/Explorers & Heliophysics Projects Division, Transiting Exoplanet Survey Satellite (TESS) Senior Resources Analyst

KEVIN N. MILLER (from 401) detail to 480/SSPD, Deputy Project Manager-Resources

ROGER CLASON (from 458) to 450/ESC Projects Division, Deputy Program Manager

ELIZABETH D. GOELLING (from 470) to 472/JPSS Flight project, Financial Manager

LISA G. SCHAPPACHER to 472/JPSS Flight project, Financial Manager

LAUREN A. TOKARCIK (from 428) to 451/Laser Communications Relay Demonstration (LCRD) project, Senior Resources Analyst

PARAMESWARAN NAIR (from 405) to 429/Landsat 9 Project, Deputy Instrument Manager

KIMBERLY A. CAVALLARO (from 474) to 423/ESDIS Project, Resources Analyst

TANJIRA AHMED (from 408) to 448/WFIRST Project Office, Financial Manager

ZULMA PHILLIPS (from 441) to 408/ SSCO, Student Trainee

JAMIE L. DUNN (from 443) to 417/ GOES-R, Deputy Project Manager/Technical

LINDSAY L. STROYEN (from 460) - detail to 490/Instrument Projects Division supporting Europa Propulsion, Senior Resources Analyst

THERESA P. QUARLES (from 421) to Polar Orbiting Environmental Satellite (POES), Deputy Project Manager-Resources

MICHELLE A. SOHL (from 490) to Instrument Projects Division, Financial Manager, supporting 497/Ocean Color Instrument (OCI) instrument project, Financial Manager

JOSEPH B. HICKMAN (from 490) to Instrument Projects Division, Senior Resources Analyst, supporting 491/Advanced Topographic Laser Altimeter System (ATLAS) instrument project

PATRICIA A. MILLER (from 490) to Instrument Projects Division, Senior Resources Analyst, supporting 493/ LCRD instrument project

TRACY L. PARLATE (from 441) to 428/ESMO Project, Deputy Project Manager-Resources

STEPHEN M. SCHMIDT (from 592) to 490/Instrument Projects Division, Supervisory-Deputy Division Manager

RUTH C. CARTER (from 470) to 401/Advanced Concepts & Formulation Office, Study Manager

ANTONIOS A. SEAS (from 401) detail to Technology Enterprise and Mission Pathfinder Office

PRESTON M. BURCH from 470) to 480/Associate Director for SSPD

LILLIAN S. REICHENTHAL from 401) to 460/Explorers & Heliophysics Projects Division, Astro-H Project Manager

CRISTINA M. DORIA-WARNER (from 443) to 483/Restore-L Project, Financial Manager

HSIAO SMITH (from 4700) to 480/SSPD, Deputy Division Manager

ANDREW E. MITCHELL (from 423) to 423/ESDIS project, Project Manager

FERZAN JAEGER (from 490.1) to Lucy Ralph (L'Ralph) Instrument Project Manager

BRENT P. ROBERTSON (from 460) to 484/Asteroid Redirect Robotic Mission (AARM) Capture Module CapM) Project Manager

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REORGANIZATIONS WITHIN CODE 400

RENAMED – 408/Satellite Servicing Capabilities Office (SSCO) to 480 Satellite Servicing Projects Division (SSPD)

ESTABLISHED – 480.1/Satellite Servicing Enabling Technologies (SSET) Office

ESTABLISHED – 481/Satellite Servicing Advanced Concepts (SSAC) Office

ESTABLISHED – 482/International Space Station (ISS) Payloads Office (IPO)

ESTABLISHED – 483/Restore-L Project Office

ESTABLISHED – 484/Asteroid Redirect Robotic Mission (AARM) Capture Module CapM) project

INACTIVATE – 433/Origins, Spectral Interpretation, Resource Identification, and Security-Regolith Explorer (OSIRIS-Rex) (pending)

ESTABLISH – 434/Lucy project (pending)

MODIFY – 492/Fast Plasma Instrument (FPI) instrument project to the High Resolution Mid-Infrared Spectrometer (HIRMES) instrument project (pending)

INACTIVATE – 494/OSIRIS Rex Visible and near–IR Spectrometer (OVIRS) instrument project (pending)**ESTABLISH** – 499/Lucy Ralph (L'Ralph) instrument project (pending)

MODIFY – 456/Space Network Expansion (SNE) to Laser-Enhanced Mission Navigation and Operations Services (LEMNOS) project (pending)

MODIFY – 461/Magnetospheric Multiscale (MMS) Project Office to X-ray Astronomy Recovery Mission (XARM) project (pending)

LISA HOFFMANN, CODE 400
ADMINISTRATIVE OFFICER

NASA NOAA JPSS Team
EYEING SEPTEMBER LAUNCH
for NOAA's JPSS-1

Production is in full swing of the Joint Polar Satellite System (JPSS-1) weather satellite with a targeted launch in September 2017.

JPSS-1 is an extension of the joint NASA/National Oceanic and Atmospheric Administration (NOAA) Suomi National Polar-orbiting Partnership (Suomi NPP) mission that launched more than 5 years ago on October 28, 2011. Suomi NPP continues to contribute to significant advances in severe weather prediction and environmental monitoring, leading to better forecasts for users worldwide. JPSS-1 will complement data collected by Suomi NPP.

Ball Aerospace, located in Boulder, Colorado, is responsible for the production of the spacecraft and integration of the five instruments. These instruments, which are similar to those found on Suomi NPP, include the Visible Infrared Imaging Radiometer Suite (VIIRS), Cross-track Infrared Sounder (CrIS), Advanced Technology Microwave Sounder (ATMS), Ozone Mapping and Profiler Suite (OMPS) and the Cloud and Earth Radiant Energy System (CERES). The sensors build on some of the capabilities pioneered by NASA's Earth Observing System satellites and the Department of Defense's Defense Meteorological Satellite Program. Additionally, teams led by Raytheon Intelligence and Information Systems in Aurora, Colorado, are preparing the next-generation Common Ground System needed for JPSS-1.

JPSS-1 Team

The data collected by Suomi NPP and the future JPSS fleet will contribute towards extending measurement records for environmental variables that have been made through the research instruments aboard satellites from NASA's Earth Observing System (Terra, Aqua, and Aura). The data collected will also build on knowledge from earlier NOAA operational platforms and NASA research satellites to help create multi-decadal environmental records.

These satellites provide information on a variety of subjects including measurements of atmosphere, oceans, and land conditions from atmospheric temperature/moisture profiles, to hurricanes, and even oil spills.

When JPSS-1 launches this Fall, it will be inserted one-half orbit ahead of Suomi NPP into the same orbital plane. That will put JPSS-1 about 50 minutes ahead of Suomi NPP in the same sun-synchronous orbit, or an orbit that passes over the same location on Earth at the same local time, allowing important overlap in observational coverage.

The weather and environmental mission data from the five JPSS instruments are stored and transmitted to Earth every orbit. Suomi NPP mission data is collected by a ground station in Svalbard, Norway, and is then routed to the NOAA Satellite Operations Facility in Suitland, Maryland, where it is processed and distributed. NOAA also has a backup facility in Fairmont, West Virginia, to ensure continuity. In addition, Suomi NPP data can be accessed through the use of direct broadcast antennas.

The new upgrades being made to the ground system in support of JPSS-1 will allow transmission to antennas at McMurdo Station, Antarctica, near the South Pole, in addition to Svalbard, Norway, to enable data to be received and routed every half-orbit, cutting the time processed data is sent to users by half.

The JPSS system supplements other largely independent programs whose data products and services are interconnected via the JPSS ground system. In addition to Suomi NPP and JPSS, the JPSS ground system supports JAXA's Global Climate Observation Mission, the Defense Meteorological Satellite Program, NASA's Space Communications and Navigation missions (Terra, Aqua, Aura, and Landsat), EUMETSAT's Meteorological Operations, the National Science Foundation's Antarctic research program at the McMurdo station, and the U.S. Navy's Coriolis/Windsat.

The NASA Goddard JPSS staff leads a large team of government and industry partners in the development of JPSS. NASA's flight team for JPSS is also well into development for JPSS-2, scheduled for 2022 readiness and into advance planning for the Polar Follow-On JPSS-3 and JPSS-4 satellites, which will extend the JPSS mission life out to 2038. ▲

JPSS PROGRAM OFFICE

KNOWLEDGE CONTINUITY
A PROJECT PERSPECTIVE

Knowledge continuity is often discussed in the context of conversations about retirement waves and the impending impact of massive retirement waves on knowledge retention within industries and organizations[1]. The topic is particularly relevant for Federal agencies, including NASA. The challenge of preventing massive knowledge loss is daunting and needs to be addressed at the organizational level. This article will take a slightly less daunting approach, focusing on the more manageable knowledge continuity challenge at the project level within Goddard teams.

PROJECT KNOWLEDGE CONTINUITY — TEAM CONTINUITY

Within the context of Goddard projects, knowledge continuity comes into play in at least two important ways: 1) staff changes associated with the project life cycle which are predictable and can be adequately planned for, and 2) staff changes that may occur at any point during the project life cycle and cannot be predicted. Let's examine both in more detail.

STAFF CHANGES ASSOCIATED WITH THE PROJECT LIFE CYCLE

Within the project life cycle, there are two major changes with knowledge continuity implications. For competed missions, the first major change happens between the proposal stage and the formulation phase. While some members of the proposal team may continue on as members of the project team during formulation, this is not always the case. Later on in the project life cycle, another important change occurs. That second change occurs once the mission has launched. After launch, it goes into its operations phase, usually managed by a completely different team. These two transitions have important implications from a knowledge continuity perspective.

The following are good and/or emerging practices related to project life-cycle changes based on Goddard's project experience:

- **Continuity beyond the Proposal Stage**

  Some staff continuity between the proposal stage and the development stage is beneficial. The capture manager leading the proposal stage does not automatically become the project manager (PM). It's not necessarily the same skill set. When the capture manager has the appropriate skill set, however, he/she can become the project manager or the deputy project manager to allow for some continuity. At times, continuity between the proposal team and beyond is maintained through members of the engineering team (systems engineer (SE) or instrument systems engineer). It helps to have one or two people on the project team who know first-hand how and why certain decisions were made at the proposal stage.

- **Continuity from Development to Operations**

  With the exception of the members of the science team on a mission, who are often involved from beginning to end, the ongoing operations of a mission once it has launched are the responsibility of a team that is completely different from the development team that built the mission. The key to a smooth change from development to operations is early engagement of the operations team in the development effort when the initial operations concepts can impact design as well as long-term operational costs. Having engagement from the operations side is critical. It's even better when the operations manager, who will eventually be in charge of the mission, is assigned to engage with the development team early on in the process. Again, continuity of staff is of great benefit and should be encouraged even if it is not always possible.

UNPLANNED STAFF CHANGES

In general, staff continuity is seen as a positive condition within a team and it is often cited as one of the reasons for a team's ultimate success. The reasons are clear. A team that works well together has established an enabling team culture in which everyone knows what is expected of them. The loss of key team members and introduction of new ones may create some disturbance in the communication patterns and other aspects of the team's operations. When the change involves core positions (PM, SE, etc…), the associated changes are likely to be more significant. Of course, there are times when a radical change in approach and culture is exactly what is intended. It is not unusual for a struggling project to see a change in leadership with a switch in the project manager. At times you need someone who is going to take a fresh look at everything, from technical issues to cost control and team dynamics, to get a project back on track.

The following are good and/or emerging practices related to staff continuity:

- **Team Communications around Staff Continuity**

  When a personnel change occurs, it must be accompanied by appropriate communications to the entire team. The replacement of a team member can be the source of stress and tensions within a team. Regardless of the cause of the departure (promotion to another position, higher management decision, personal/health reasons; etc…), the departure needs to be communicated to the team rather than be a surprise without explanation.

- **Learning Curve for New Team Members and New Stakeholders**

  Don't leave it up to the new team members to catch up with everyone else. Help them out. Ground rules, existing agreements, and understandings need to be communicated to the new team members. Similar challenges occur when key stakeholders are replaced. Sometimes it's not new project team members who need to be quickly on-boarded within the team, but a new member of a review board who needs to be brought up to speed. Sometimes a key stakeholder at Headquarters, such as the Program Executive (PE), is switched. Regardless of the internal or external stakeholder, a new relationship may need to be established. Trust needs to be built. It takes time and effort but it should not be ignored.

For some Federal agencies, for example the State Department, the knowledge management challenge associated with continuity is a critical one because State Department employees rotate in and out of positions every 2 years. This would obviously wreak havoc on a NASA mission. The transfer of critical knowledge from one staff to another becomes a never-ending activity where some standardization can be very useful.
In addition to the very predictable changes between stages of the project life cycle and the unplanned staff changes, there are other potential staff continuity issues that may arise due to contract changes. Key positions on projects, such as positions involving in-depth knowledge of an instrument or a process, are held by contractors rather than civil servants. Should the contract be scheduled for a rebid and the incumbent lose, access to key individuals' expertise could be lost.

Keeping an eye on knowledge continuity throughout the project life cycle is key to project success and it involves more than trying to capture retirees' knowledge before they leave. ▲

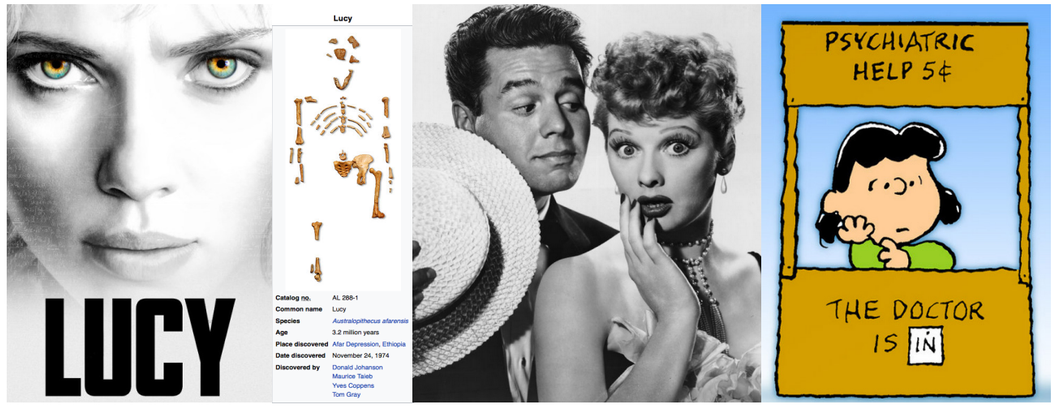
BARBARA FILLIP, CODE 400
FPD KNOWLEDGE MANAGEMENT LEAD

[1]See David DeLong's book, Lost Knowledge: Confronting the Threat of an Aging Workforce, 2004.

WHAT'S IN A NAME?

https://www.nasa.gov/feature/goddard/2017/nasa-selects-mission-to-study-jupiter-s-trojan-asteroids

On January 4, 2017, after a 9-month Phase A, NASA Science Mission Directorate (SMD) selected two Discovery–14 missions: Lucy and Psyche. Psyche is simply named after the asteroid the spacecraft is going to visit. Lucy is something different altogether…here's a collection of some of the most popular Lucys:



Which one is the mission's namesake? It's the fossil… The Lucy mission Principal Investigator (PI), Dr. Harold (Hal) Levison, Southwest Research Institute (SwRI), formulated a mission to perform flybys of the population of asteroids captured in Jupiter's orbit at the L4 and L5 Lagrange points. These asteroids are known as the Jupiter Trojans and it's believed they are fossils of our solar systems' planet formation. Trojans are a mystery in that they are not included in Earth's population of meteorites due to their gravitationally arrested state. Lucy's flybys of the Trojan population will be the first ever to these small bodies. Given a desire to stay away from clever acronyms, Hal named the mission "Lucy" – after the fossil discovered in Africa in 1974 by Donald Johanson.

The Lucy mission extends some key Goddard partnerships that have been very successful. The PI is from SwRI, which GSFC successfully teamed with on the Magnetospheric Multiscale (MMS) mission. The spacecraft is being built by Lockheed Martin, following in the footsteps of MAVEN and OSIRIS-REx – two planetary spacecraft developments that were delivered on time and under budget. The instruments lineage is from New Horizons (Long Range Reconnaissance Imager (LORRI) and Ralph) and OSIRIS-REx (Thermal Emission Spectrometer / TES). The Ralph instrument will be developed here at GSFC. The instrument PI is Dr. Dennis Reuter and the instrument project manager (PM) is Ferzan Jaeger. The Lucy project picks up where OSIRIS-REx left off. The Lucy PM, deputy project manager (DPM), DPM/resources, financial managers, and project support team are the same individuals from OSIRIS-REx in the same positions. During the OSIRIS-REx integration and test and launch campaign, the Center was heavily involved in two Discovery proposal efforts. Most of us were on the Lucy effort (though some staff were on the "other team"), writing the management and cost sections and were blessed to be selected.

Lucy will launch from Kennedy Space Center (KSC) in October 2021. After two trips around the Sun, Lucy will perform its first flyby – a preparatory activity to rehearse the elements of the Trojan flybys – of a main belt asteroid named DonaldJohanson in April 2025. This asteroid was named after the discoverer of the Lucy fossil after being selected as a target. From there it's on to the L4 Trojans. The mission will fly by Eurybates in August 2027, Polymele in September 2027, Leucus in April 2028 and Orus in November 2028. Coming back around the Sun for a third time and then out to the L5 Trojans, the mission finishes with a flyby of the binary-pair Patroclus and Menoetius in March 2033.

The Lucy mission will last 11.4 years, and over the course of development and operations (Phases A – F), Lucy will bring over $85M (RY$ - without reserves) to the Center in salaries and hardware development (Ralph) and will extend GSFC's streak of excellent performance on planetary missions.

One last Lucy tie-in. The Lucy PI requested and received permission to use the "I Love Lucy" logo from the CBS television show.

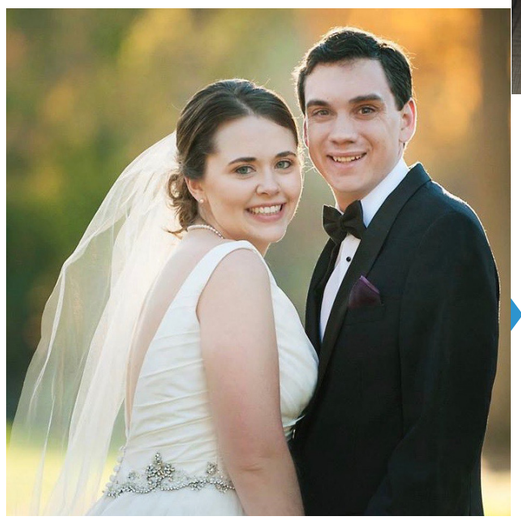
MIKE DONNELLY, CODE 434
LUCY PROJECT MANAGER

OUT & ABOUT

LIFE'S HIGHLIGHTS OFF CAMPUS

Steve Horowitz/440 is a proud father for the second time. He and his wife adopted a beautiful baby girl. Sophia Perry was born on November 22, 2016. Steve, Michelle and big brother, Alex are thrilled to welcome Sophia home.

Congratulations to Barbara Haskell (Code 403) on the birth of her new grandson. Her daughter, Stephanie Blade and her husband Nolan had their first baby, on January 27, 2017 at 11:02 AM. Austin Gordon Blade weighed 6 lbs. 14 oz. and was 19 inches long.



Andrew Ochs (443) and Sarah Joyner were married on November 5, 2016 in Annapolis. Andrew Ochs (443) and Sarah Joyner were married on November 5, 2016 in Annapolis. Following a honeymoon in Jamaica, the couple now reside in the Annapolis area and are settling into married life. Andrew works at GSFC as an Integration and Test Engineer for ATA and Sarah is a dietitian in a rehabilitation/long-term care facility in Waugh Chapel.

On behalf of the 2016 Combined Federal Campaign (CFC) Team and the Flight Projects Directorate (FPD), many thanks to all who contributed to the 2016 campaign.

For the second year in a row, FPD exceeded their goal of $70,900 with 86 pledges totaling $82,822.

This accomplishment demonstrates the unselfishness of our employees and our commitment and dedication to public service. Overall, as a Center, Greenbelt contributed and pledged a total of $504,612 to the CFCNCA's total campaign total of $46,650,415.

Special thanks to all the Code 400 Keyworkers:

400 - Karen Rogers
405 - Michele Towle
407 - Patricia Fogleman
420 - Lori Dellagatta
433 - Nita Pszcolka
441 - Olivia Lupie
443 - Gail Dellagatta
444 - Kelly Hyde
450 - JoAnn Brasted
450.2 - Miles Glasgow
452 - Diane Rawlings
454 - Brett Weeks
458 - Jennifer Baldwin
460 - Angela Conley
460 - Paula Wood
470 - Deborah Hamby

FLIGHT PROJECTS

LAUNCH SCHEDULE 2017